Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Modes of elastic plates and shells in water driven by modulated radiation pressure of focused ultrasound[1] PHILIP L. MARSTON, TIMOTHY D. DANIEL, Washington State University, AHMAD T. ABAWI, HLS Research, IVARS KIRSTEINS, NUWC — The modulated radiation pressure (MRP) of ultrasound has been used for decades to selectively excite low frequency modes associated with surface tension of fluid objects in water [1, 2]. Much less is known about the excitation of low frequency modes of less compliant metallic objects. Here we use MRP of focused ultrasound to excite resonant flexural vibrations of a circular metal plate in water. The source transducer was driven with a double-sideband suppressed carrier voltage as in [1]. The response of the target (detected with a hydrophone) was at twice the modulation frequency and proportional to the square of the drive voltage. Since the radiation pressure of focused beams is spatially localized, mode shapes could be identified by scanning the source along the target while measuring the target's response. Additional measurements were done with an open-ended water-filled copper circular cylindrical shell in which resonant frequencies and mode shapes were also identified. These experiments show how focused ultrasound can be used to identify low-frequency modes of elastic objects without direct contact. [1] P. L. Marston and R. E. Apfel, J. Acoust. Soc. Am. 67, 27–37 (1980). [2] S. F. Morse, D. B. Thiessen, and P. L. Marston, Phys. Fluids 8, 3-5 (1996).

[1]Supported by ONR.

Philip Marston
Washington State University

Date submitted: 01 Aug 2015 Electronic form version 1.4